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ALARA from a Regulatory Perspective

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Regulatory Framework

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- *Licensees shall use, to the extent practical, procedures and engineering controls…* to achieve occupational doses that are ALARA (10 CFR 20.1101)
- For occupational ALARA programs…
  - Compliance is judged on whether the licensee has incorporated measures to track and if necessary to reduce exposures not whether exposures represent absolute minimum (56 FR 23360, May 21, 1991)
- NRC oversight is performance-based and risk-informed
  - What is "Reasonably Achievable"?
  - Collective dose is factored into evaluation of occupational ALARA programs under the Reactor Oversight Process (ROP)

U.S. Commercial LWR Collective Dose 1974 – 2016

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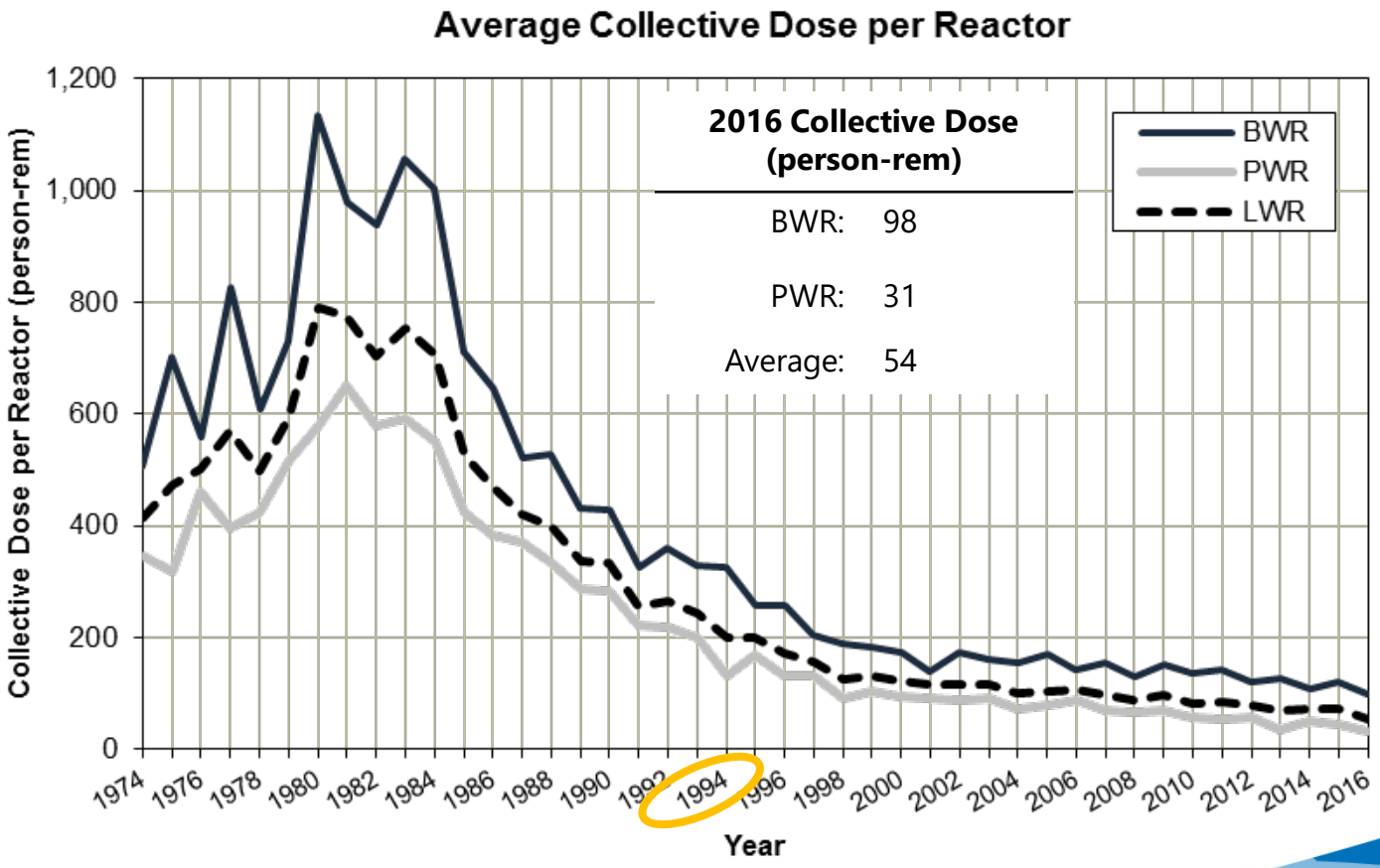

Average Measurable Dose per Worker 1974 – 2016

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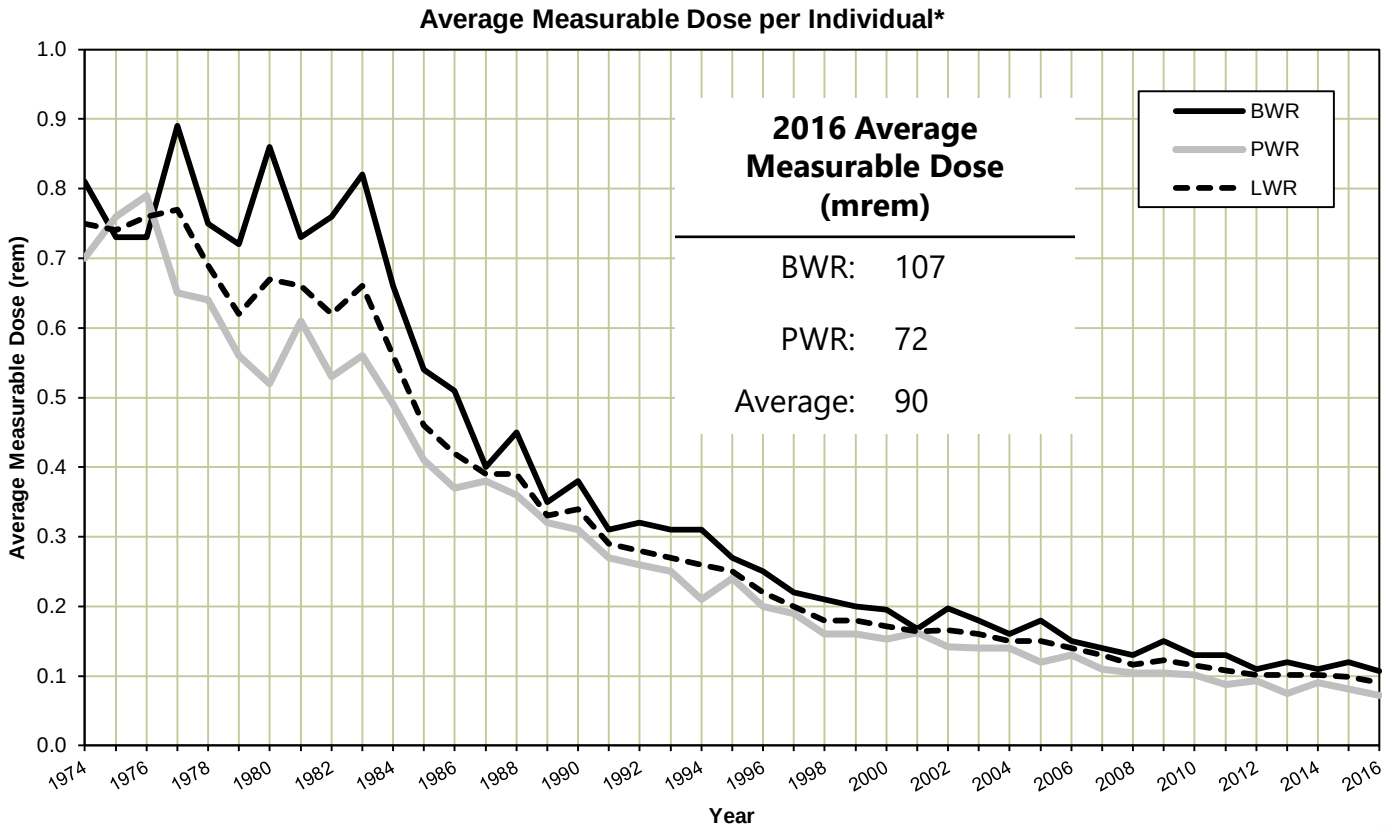

* Not adjusted for transient workers.

Average Number of Workers with Measurable Dose 1974 – 2016

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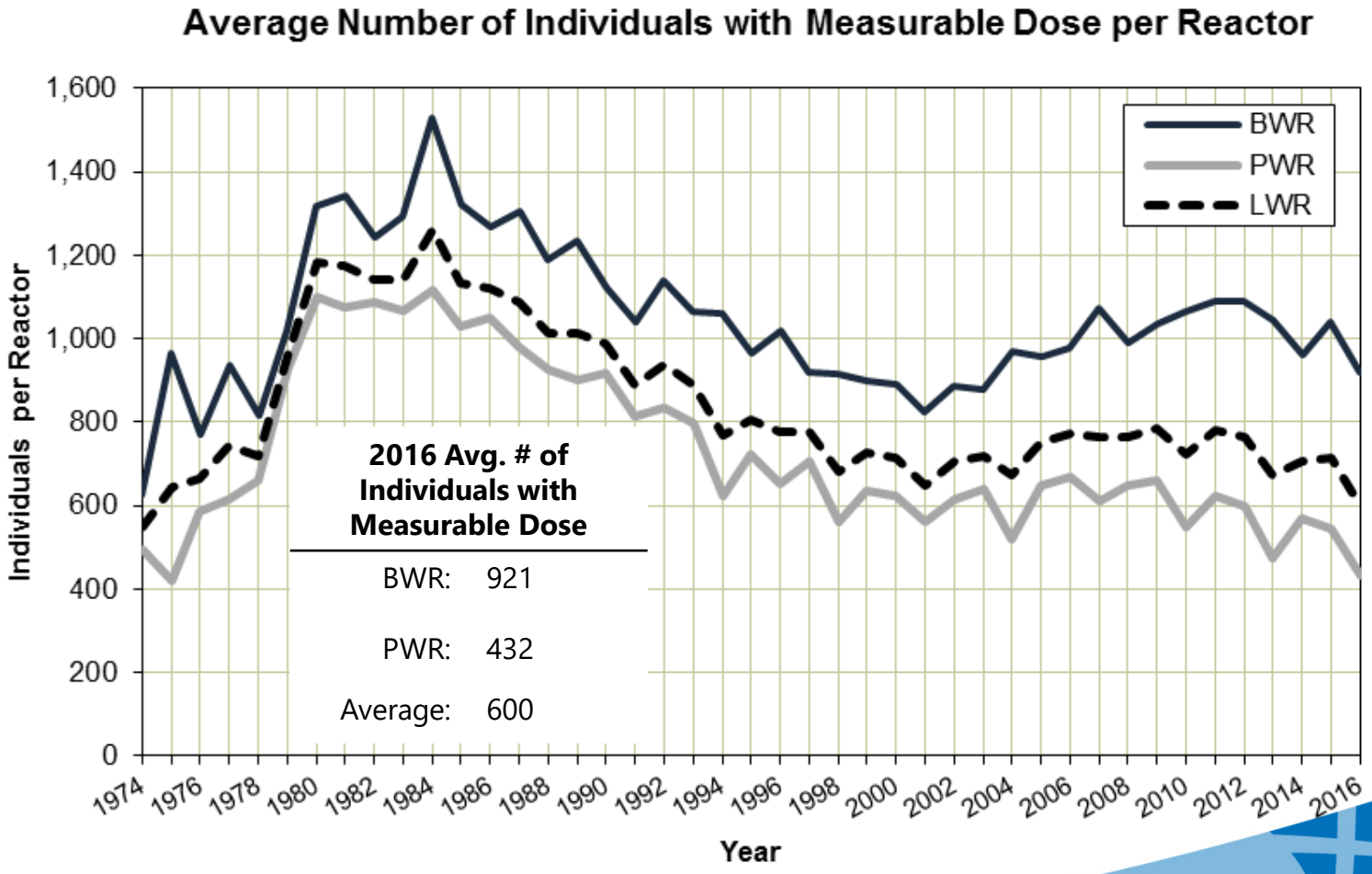

Oversight of Occupational ALARA

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- ALARA Planning is an Inspectable Area under the ROP
- Inspection Procedure 71124.02 (revised Jan. 2018)
  - Radiological Work Planning
  - Verification of Dose Estimates
  - Implementation of ALARA Work Controls
  - Radiation Worker Performance
  - Problem Identification and Resolution
- Industrywide data is used to develop plant-specific, three year averages for collective dose and to develop dose quartiles
  - Guides planning of inspection efforts
  - Used in assessment of inspection finding significance

ALARA Inspections

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- Inspection effort generally determined by licensee quartile standing
  - Also consider scope of radiological work and trends
  - IP 71124.02 (revised Jan. 2018) biennial hours range from 32 to 60 (average 46)
  - Licensees in lowest dose [highest dose] quartile should get the minimum [maximum] inspection effort
  - Licensees in middle two quartiles should get 46 hours (adjusted for effectiveness of ALARA and source-term-reduction efforts)

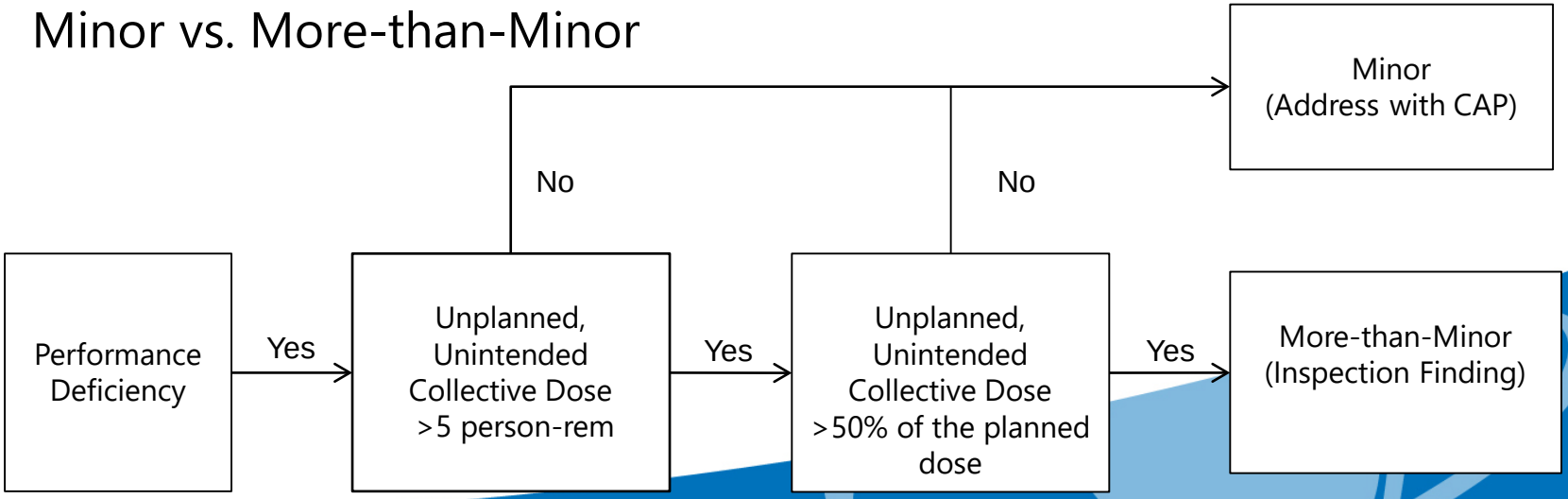
- Plant-specific, three year average is used to assess significance of ALARA Findings

ALARA Issue Screening

- ALARA Findings: More-than-Minor, performance deficiencies that concern *unplanned, unintended occupational collective dose resulting from a deficiency in ALARA planning or work control* (IMC 0609 App C)

- Performance Deficiency: Failure to meet a requirement or self-imposed standard where the cause was reasonably within the licensee's ability to foresee and correct; and thus prevent (IMC 0612)

- Minor vs. More-than-Minor



ALARA Significance Determination Process

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- If plant-specific, three year average is ≤ threshold, significance of ALARA finding is assessed to be Green (IMC 0609)
  - Boiling Water Reactor: 240 person-rem
  - Pressurized Water Reactor: 135 person-rem
- If plant-specific, three year average is > threshold, consider the magnitude of the issue and collective dose associated with recent issues
  - Magnitude of issue: Did actual dose exceed 25 person-rem?
    - No, then a Green finding
    - Yes, then a White finding
  - Consider recent issues: Were there more than 4 occurrences where actual dose > 5 person-rem and > 50% above dose estimate?
    - No, then a Green finding
    - Yes, then a White finding

Boiling Water Reactor Quartiles

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BWR Quartiles	Plant	Three Year Collective TEDE per Reactor Year 2014-2016 (person-rem)
1st Quartile	Top	50
	Bottom	72
2nd Quartile	Top	78
	Bottom	110
3rd Quartile	Top	110
	Bottom	133
4th Quartile	Top	142
	Bottom	201 (IMC 0609 threshold is 240)
Average per Reactor-Year		110

Pressurized Water Reactor Quartiles

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PWR Quartiles	Plant	Three Year Collective TEDE per Reactor Year 2014-2016 (person-rem)
1st Quartile	Top	20
	Bottom	30
2nd Quartile	Top	30
	Bottom	38
3rd Quartile	Top	39
	Bottom	46
4th Quartile	Top	47
	Bottom	241 (IMC 0609 threshold is 135)
Average per Reactor-Year		42

How to Give us Feedback

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- Inspectors
- Conferences
- Reactor Oversight Process Monthly Public Meeting
- Write a Letter
  - Raise an Issue
  - Request a Meeting
- Public Comment Periods on Published Documents

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Questions and Discussion

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Regulatory Panel